# NASA Activities

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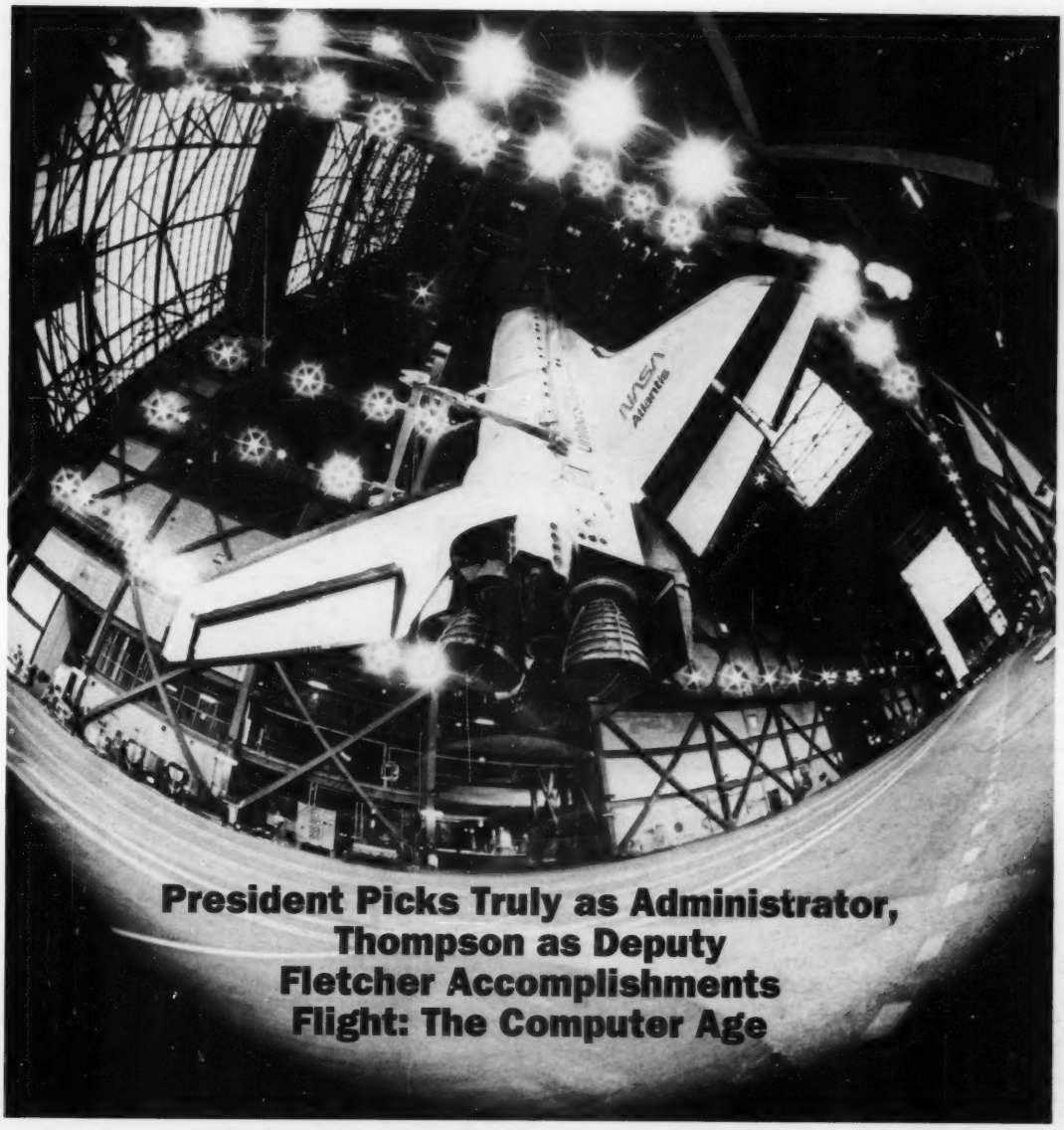



**President Picks Truly as Administrator,**
**Thompson as Deputy**
**Fletcher Accomplishments**
**Flight: The Computer Age**

## THIS ISSUE

**The changing of the guard** behind the seventh floor green doors signals new and grand opportunities ahead for NASA. Dr. James C. Fletcher leaves NASA with a well deserved "Well done, thou good and faithful servant": The U.S. civil space program is back on track with a more reliable space transportation system, NASA workers should be moving forward with high hopes and high spirits with four "return to flight" shuttle missions under their belt, a host of science missions on the docket, a Neptune encounter this summer, plans being developed for manned exploration of the solar system, and a proven leader nominated as their administrator.

The Smithsonian's **National Air and Space Museum opens the doors of its new exhibit on aerospace computing.** NASA support of the exhibit is healthy, reflecting a lot of our efforts in the field. A special section is devoted to the subject.

Salute to the crew and mission of **STS-30, the first planetary mission launched by the Space Shuttle.**

Unusually clear atmospheric conditions resulted in **uniquely clear earth photos from the STS-26 mission.** Samples are provided.

**The blood glucose level of diabetics** may be monitored more easily with a new device being developed. See "Another Dividend from Air and Space" for details...

### Next Month:

**X-15 Revisited:** 30 years ahead of its time.

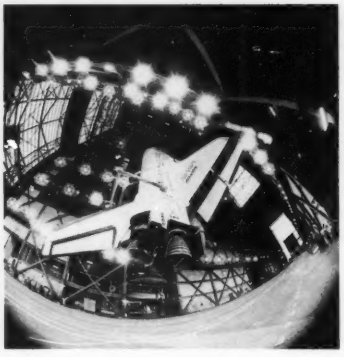
## CONTENTS

President Selects Truly as Administrator ..... 3
National Air and Space Museum Opens Computer Age Flight Exhibit, NASA Contributions Major ..... 4

**Agency Highlights**
Magellan Deploy Marks First Planetary Mission Using Shuttle ..... 7
U.S./USSR to Implement Medical Communication Link ..... 8
NASA and Japan Sign Space Station MOU ..... 8
U.S. Government Regains $19 Million from Engine Program ..... 8
Administrator Fletcher Resigns ..... 9
**NASA Visions:** Discovery's Return-to-Flight Photographs Record Many Firsts ..... 10

**Center Highlights**
Gramm Visits JSC, Predicts "Make or Break" Year ..... 12
Advanced Wing Flight Program Completed ..... 13
Search for Missing Planes: Sensors Quicker Than the Eye? ..... 13
Marshall Supports Technology Transfer ..... 14
Heavy Rain at Langley ..... 15
F-16XL Sustained Supersonic Airflow Flight Tests Planned ..... 15

**Departments**
Q&A: Space Suits for the Space Station ..... 16
NASA News Capsules ..... 17
Thompson Named Deputy Administrator, Myers Departs ..... 18
Human Factors. ..... 19
**Another Dividend From Air & Space:** Glucose Monitor ..... 20



### About the Cover

**The Orbiter Atlantis** is lifted in the Vehicle Assembly Building's transfer aisle in preparation for mating with solid rocket boosters and its external tank. The STS-30 Atlantis' cargo is Magellan, deployed to radar map the surface of Venus. Magellan is the first planetary mission carried by the Shuttle.

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# President Selects Truly as Administrator

## First Astronaut Nominated to Top Post

President George Bush has selected Richard H. Truly to be Administrator of NASA, succeeding James C. Fletcher, who retired April 8, after serving two separate terms as space agency administrator.

In announcing the nomination the President said, "...this marks the first time in its distinguished history that NASA will be led by a hero of its own making, an astronaut who had been to space, a man who has uniquely experienced NASA's tremendous teamwork and achievement."

Truly, a Navy Rear Admiral, served as NASA's associate administrator for spaceflight since February 1986, when he came to the agency to help lead it's "return to flight" effort following the Challenger accident.

Truly joined NASA as an Astronaut in 1969. He was a capsule communicator for all three Skylab missions and for the Apollo/Soyuz test program in 1975.

He served as a Space Shuttle Pilot for the 747/Enterprise approach and landing test flights in 1977, then as a backup pilot for STS-1, the first orbital flight test of the Shuttle.

Truly's first space flight was as pilot on STS-2 in November 1981 aboard the Space Shuttle Columbia, the first time a manned spacecraft was reflown in space. In August and September 1983, he flew as commander of the STS-8 mission aboard the Space Shuttle Challenger, the first night launch and landing in the Shuttle program.

Truly left NASA to become the first commander of the Naval Space Command in October 1983. Naval Space Command became the naval component of the U.S. Space Command in October 1985.

Prior to joining NASA in 1969, Truly was selected as one of the first astronauts in the U.S. Air Force's Manned Orbiting Laboratory program. From 1963 to 1965 he was a student, then instructor at the USAF Aerospace Research Pilot School, Edwards AFB, California.

Richard H. Truly

Awarded his gold pilot's wings as a naval aviator in October 1960, Truly flew F-8 Crusader supersonic jet fighters aboard the *USS Intrepid* (CVA-11) and the *USS Enterprise* (CVN-65), making more than 300 carrier landings. He has logged over 7,000 hours in numerous military jet aircraft and over 199 hours in space.

Truly received the Presidential Citizen's Medal from President Reagan in January 1989. His military decorations include the Defense Distinguished Service Medal, the Defense Superior Service Medal, two Legions of Merit, the Navy Distinguished Flying Cross, and the Meritorious Service Medal.

His NASA Awards include two NASA Distinguished Service Medals, the NASA Outstanding Leadership Medal, two NASA Exceptional Service Medals and two NASA Space Flight Medals.

He is also the recipient of the Society of Experimental Test Pilot's Ivan C. Kinchloe Award (1978) and the James H. Doolittle Award (1988), the Air Force Association's David C. Shilling Award (1978), the American Astronautical Society's Flight Achievement Award (1977), the American Institute of Aeronautics and Astronautics Haley Space Flight Award (1980), the Robert H. Goddard Memorial Trophy (twice, 1982 and 1989), the Thomas D. White Space Trophy (1982), the Robert J. Collier Trophy (twice, 1982 and 1989), the Harmon International Trophy (1982), The Federation Aeronautique Internationale Gold Space Medal (1984), the Boy Scouts of America Distinguished Eagle Scout Award, and the Medal of Honor of the National Society of the Daughters of the American Revolution.

# National Air and Space Museum Opens Computer Flight Exhibit

## NASA Contributions Major

**One of the first vehicles in which computational aerodynamics played a large design role, the HiMAT (Highly Maneuverable Aircraft Technology) research aircraft turns nearly twice as sharply at transonic speeds as today's fighter aircraft. NASA test pilots flew the sub-scale supersonic plane by computer-assisted remote control.**

The "computer revolution" in aerospace is the subject of a major new gallery, "Beyond the Limits: Flight enters the Computer Age," at the Smithsonian Institution's National Air and Space Museum.

Organized in seven exhibit areas, the gallery illustrates the primary applications of the computer in aerospace: design, aerodynamics, computer-aided manufacture, flight testing, air operations, flight simulators and space operations. Each exhibit includes at least one "hands-on" interactive computer terminal so that visitors can see for themselves the kinds of tasks that computers perform.

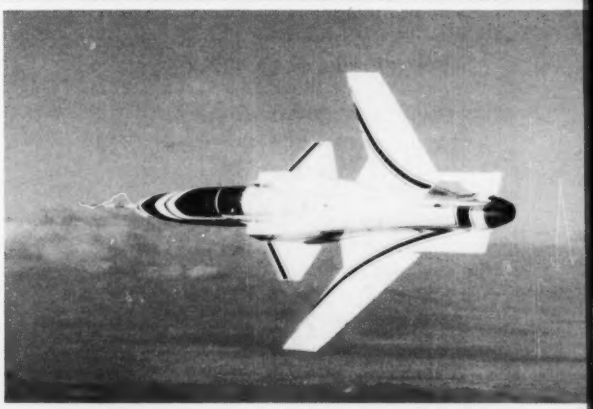
"Beyond the Limits" traces the development of the computer and aerospace industries from the 1940s, when the typical "computer system" was a room full of people working with slide rules, pencils and paper. As electronic computers became smaller, lighter, more reliable and more powerful, aerospace engineers found hundreds of applications for them.

For instance, as the "Space Operations" exhibit demonstrates, the Apollo guidance computer was crucial in landing men on the moon and returning them safely to Earth.

The Mariner 10 spacecraft, the first man-made object to fly past more than one planet, was equipped with on-board computers that allowed it to be directed through space by Earth-based controllers. A flight back-up of Mariner 10 is on display in the space operations exhibit.

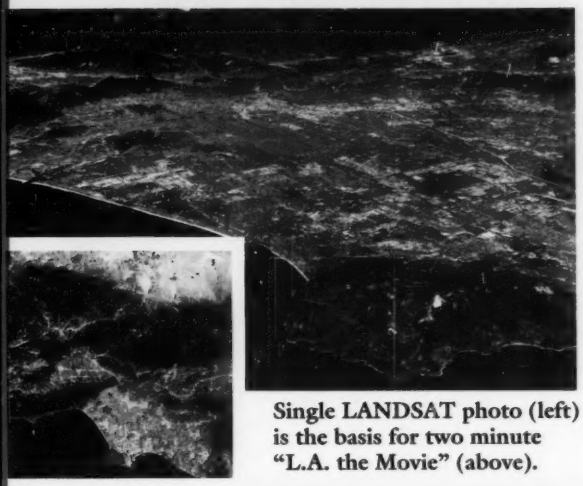
The radical X-29 research aircraft with its forward-sweeping wings is literally too unstable to fly without its onboard computers. A full scale model is on exhibit, as well as spectacular footage taken at NASA' s Ames-Dryden Flight Research Facility showing the aircraft in flight.

The X-29 was also designed and built with the aid of computers. The new gallery features a CRAY-1, one of the first production-model supercomputers. These machines perform billions of calculations in seconds and generate graphics that model aerodynamic forces as accurately as the most sophisticated wind tunnels.



**X-29 flight research at NASA Ames-Dryden.**

## JPL's Computer-Generated Movies



Single LANDSAT photo (left) is the basis for two minute "L.A. the Movie" (above).

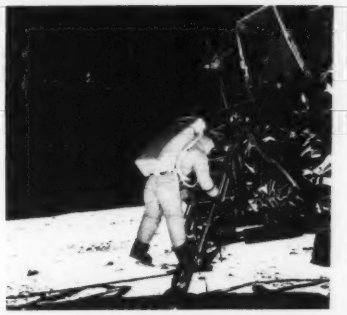
Of all of the imaginative uses of the computer throughout NASA, one of the most dramatic combines surface images with advanced computer processing to create breathtaking and whirlwind three-dimensional animated "flights" over planetary topographic features.

Since the first creation of this type, titled "L.A. the Movie," imaging scientists at the Jet Propulsion Laboratory (JPL) have created "Earth the Movie," "Miranda the Movie" and, most recently, "Mars the Movie."

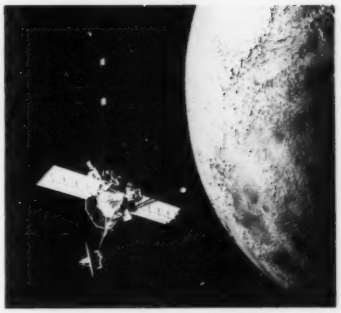
To develop the prototype for those that followed, a single LANDSAT photo, taken July 5, 1985, from five miles up, was computer-manipulated and enhanced for "L.A. the Movie" To create the dramatic "flight" effect, the image was combined with elevation data.

*continued on next page*

Apollo 11 Astronaut Edwin E. Aldrin descends Lunar Module steps during the first landing on the moon.

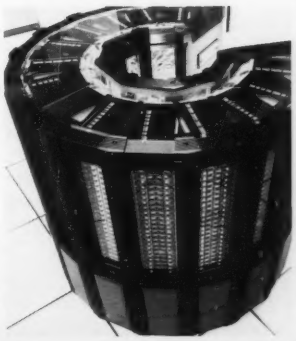


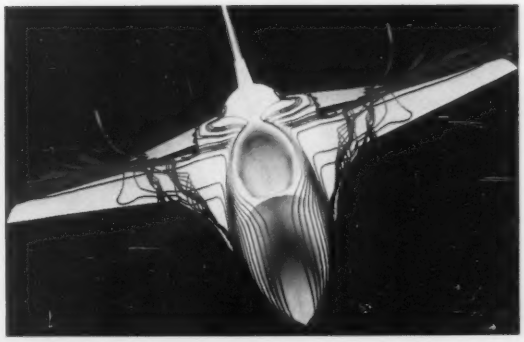
The Mariner 10 spacecraft investgates Mecury in this artist's depiction of the 1973-74 dual planetary mission.



## ARC's Numerical Aerodynamic Simulator

Ames Research Center's Numerical Aerodynamic Simulator (NAS) provides world class supercomputing capability easily accessed by America's top aerospace researchers. Flow from an F-16's forebody are depicted by this computational fluid dynamics visualization (2nd right) The Cray 2 supercomputer is part of the NAS system.





## Movies

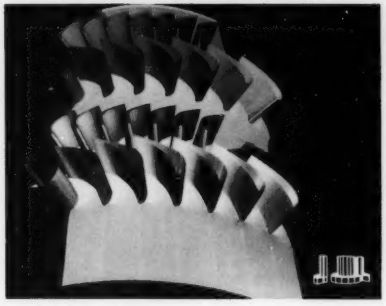
from page 5

The two-minute film sends viewers swooping over various L.A. area landmarks.

Itinerary for the latest release, "Mars the Movie" — also a two-minute simulated flight — takes the viewer at fantastic speeds down continental sized chasms and over giant volcanoes.

Animation techniques developed during these proof-of-concepts projects will be used by NASA scientists to study the three-dimensional nature of global cloud cover. Studies of the world's weather system, in turn, are expected to lead to improved weather prediction, benefitting many industries.

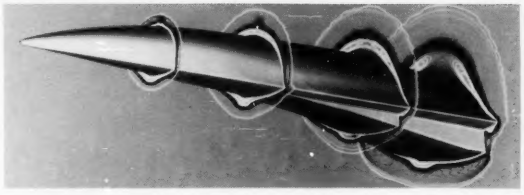
## Lewis Using CFD for Propulsion Study



Computational simulations are being used by Lewis Research Center to study the migration of hot gasses through the Space Shuttle main engine fuel turbine. Pressure fields are shown in the illustration (right). Providing verified computer codes to better understand factors which limit turbine life and lead to the design of advanced components is the goal.

Computational Fluid Dynamics is also being used at Lewis to study advanced turboprop propellers, thermal footprints and flow fields of short takeoff, vertical landing aircraft and airflow in engine parts.

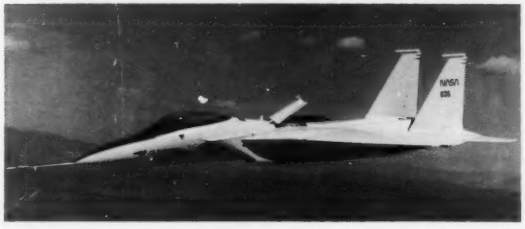
## Langley's Computers Solve Aero Problems



Langley researchers are using one of the most sophisticated and powerful research computer systems to develop a hypersonic plane, define the limits of speed and maneuverability of aircraft, study space stations and to help prevent the breakdown of the Earth's ozone.

Computer codes that simulate highspeed flow around an X-30 aircraft shape are being developed and verified from available wind tunnel data. Heavy dependence on computer codes is required, since wind tunnel facilities may not have the ability to model the entire X-30 flight regime. In this picture (right) contour lines indicate temperatures at Mach 19 around a generic vehicle similar to the X-30.

## Dryden's Computerized Flight Systems



At Ames-Dryden, engineers have devised computer programs and hardware modifications to make it possible for a fighter aircraft's propulsion system and flight control systems to "converse" during flight and thus adjust themselves to get the best possible performance from the aircraft.

Called Highly Integrated Digital Electronic Control (HIDEC), the system is flown on the Ames-Dryden F-15, however, origins of the program date back to early supersonic cruise airplanes such as the YF-12 and XB-70. With the advent of these aircraft, researchers noted that the propulsion system had very strong interactions with the airplane and flight control system, and that control integration could be beneficial.

Ames-Dryden took the first step towards integration when it developed the first digital flight control system on its F-8 aircraft in 1972. Now, digital systems are the standard for fighter aircraft and newer transport airplanes and more complex systems are being studied.

# Magellan Deploy Marks First Planetary Mission Using Shuttle

## The STS-30 Crew

(from left to right)

**David M. Walker,** Captain, USN, Mission Commander. Walker was pilot of STS 51-A which deployed two satellites and retrieved two satellites for return to Earth. His assignments also have included: Astronaut Office safety officer; deputy chief of Aircraft Operations and STS-1 chase pilot. He has logged a total of 192 hours in space.

**Ronald J. Grabe,** Colonel, USAF, Pilot. Grabe was pilot for STS 51-I, a DOD mission and has logged 98 hours in space. As an Air Force Flight Test Center test pilot, he flew the A-7 and F-111. He also served as an exchange test pilot with the Royal Air Force. He was an instructor at the USAF Test Pilot School at Edwards when advised of his astronaut selection by NASA.

**Norman E. Thagard,** M.D., Mission Specialist 1. Thagard was a mission specialist on STS 7, which operated the Canadian-built Remote Manipulator System (RMS) arm to perform the first satellite deployment and retrieval exercise, and carried OSTA 2. During the flight, Thagard conducted various medical tests. Mission Specialist on STS 51-B, the Spacelab-3 science mission, he has logged over 323 hours in space.

**Mary L. Cleave,** Mission Specialist 2. Cleave was a mission specialist on STS 61-B which deployed communications satellites and conducted two 6-hour spacewalks to demonstrate Space Station construction techniques. She also has worked as a Capsule Communicator (CAPCOM) in the Mission Control Center on five Space Shuttle flights and has logged a total of 165 hours in space.

**Mark C. Lee,** Major, USAF, Mission Specialist 3. A member of the astronaut class of 1984, this is his first space flight. Lee has participated in the planning and simulation of several extravehicular activity (EVA) missions and has served as the support crew member for mission 51-I, Leasat retrieval and repair. He also has served as a CAPCOM.

Space Shuttle mission STS-30 will deploy the Magellan spacecraft, the first U.S. planetary spacecraft launched since Pioneer Venus in 1978, and the first planetary probe ever to be deployed from the Shuttle. (See "Magellan: Exploring Venus as Never Before", *NASA Activities*, Feb. 1989.)

Magellan will map about 70 to 90 percent of the surface of planet Venus for the first time using a synthetic aperture radar instrument to create high-resolution images. Computer processing on Earth will provide data quality as if Magellan's antenna was hundreds of meters long though the actual antenna is only 12 feet in diameter.

Following deployment, Magellan will be propelled on its Venus trajectory by an Air Force-developed, Inertial Upper Stage (IUS). Once away from Earth's gravitational pull, the spacecraft will cruise for several months before reaching its destination in August 1990. Orbit insertion rockets will fire to put Magellan into a circular orbit around the planet, making one revolution every 189 minutes. During its 243-day mission, the spacecraft will acquire imaging, radiometry, altimetry and gravity data. Liftoff of the fourth flight of orbiter Atlantis was scheduled for 2:24 p.m. EDT, April 28, from Kennedy Space Center, Fla., launch complex 39-B, into a 184 mile, 28.85-degree orbit. Nominal mission duration is 4 days, 56 minutes. Deorbit is planned on orbit 64, with landing scheduled for 3:20 p.m. EDT on May 2 at Edwards Air Force Base, Calif..

Atlantis also carries several secondary payloads involving fluid research in general liquid chemistry and electrical storm studies.

After landing, Atlantis will be deserviced at NASA Ames- Dryden Flight Research Facility, Edwards, prior to ferry back to the Kennedy Space Center. ■

# EXTERNAL RELATIONS

## U.S./USSR To Implement Medical Communication

Representatives from NASA and the USSR Ministry of Health agreed in Moscow to make U.S. medical expertise available to the Soviet Union in response to long term medical problems arising from the December 1988 earthquake in Armenia. NASA proposed combining its expertise in satellite communications with the unusual medical care capabilities required by space flight to provide a resource that may help solve medical problems in the aftermath of the earthquake.

The proposed "telemedic spacebridge" demonstration will address the longer term consequences of the disaster and is planned for a period of several months. It will provide medical consultation to support rehabilitation, reconstructive surgery, physical therapy, public health and psychological counseling.

Under the plan, U.S. medical facilities would be linked by satellite with Soviet hospitals and rehabilitation centers. Comsat Corporation and Intelsat have offered to provide satellite transponder time free of charge. NASA will provide a compatible satellite ground terminal to be installed in Armenia. The link would provide one way television and two way voice capabilities for several hours a day, 2 days a week. The link is scheduled to begin operation this spring. While the communications would be directly between hospitals in the U.S. and the USSR, NASA also would provide a small project management center at NASA's Goddard Space Flight Center, staffed with communications and medical personnel to assure proper functioning of the link. ■

## NASA and Japan Sign Space Station MOU

NASA Administrator Dr. James C. Fletcher and the Ambassador of Japan to the United States, H. E. Nobuo Matsunaga, have signed a memorandum of understanding (MOU) between the U.S. National Aeronautics and Space Administration and the government of Japan on cooperation in the permanently-inhabited Space Station.

The agreement was signed at a brief ceremony at NASA Headquarters.

Comparable MOUs with the European Space Agency and Canada were signed, along with an inter-governmental agreement, in a ceremony held at the U.S. State Department last September. The MOUs signed between NASA and its three partners focus on programmatic and technical aspects of the cooperative effort and establish the management mechanisms necessary to carry out the Freedom program.

Under the agreements, Japan will provide the Japanese Experiment Module (JEM) to the Freedom program. The JEM, to be permanently attached to the space station base, consists of a pressurized laboratory module, at least two experiment logistics modules and an exposed facility, which will allow experiments to be exposed to the space environment.

Experimenters will conduct materials processing and life sciences research in the laboratory module, while the logistics module can be used to ferry materials between the station and Earth and for storing experimental specimens and various gases and consumables. ■

## U.S. Government Regains $19 Million from Aircraft Engine Program

A NASA program that has saved billions of gallons of fuel and reduced aircraft engine noise has put more than $19 million back into the U.S. Treasury.

On Feb. 28, Pratt & Whitney, a unit of United Technologies, presented a check for $3,028,951 to NASA's Lewis Research Center. The check brings to $19.2 million the amount the company has paid the government through recovery-of-cost provisions on R&D programs begun in the 1970s largely as a result of the oil crisis.

> . . . savings of from two to four billion gallons of fuel . . .

Improvements to jet aircraft engines resulting from the programs have meant savings of from two-to four-billion gallons of fuel, worth between $1.5 billion to $3 billion, for aircraft entering service in the U.S. through 1990.

In the 1970s, Lewis provided a total of $26.3 million for specific fuel, and noise-related research and development, on two existing Pratt & Whitney engines, the JT8D and JT9D, both widely used on commercial jetliners.

Pratt & Whitney is making repayments under a contract provision designed to recoup the government investment in cases where a company could gain commercial sales as a result of a NASA program.

The repayments are based on sales receipts and licenses and technical agreements which permit others to sell, lease or manufacture parts for JT8D and JT9D engines. The repayment to NASA of the remaining $7.1 million in cost-recovery funding should be completed in 1990. ■

# Administrator Fletcher Resigns

Dr. James C. Fletcher

NASA Administrator Dr. James C. Fletcher resigned April 8, as leader of the nation's space agency.
Fletcher, who was brought back for a second term as administrator after the Challenger accident, said that with the successful conclusion of the third post-Challenger Space Shuttle mission, he felt that he could safely place the leadership of NASA in another's hands.

In his resignation letter to the president, he pledged to continue to work with his successor when appropriate.

Commenting later on Fletcher's service, President Bush said, "NASA's accomplishments are a source of pride to all Americans...I would be remiss indeed, if I didn't thank Dr. Fletcher once again for an outstanding job as NASA administrator...I can tell you —I seldom speak for the Congress— but he has been an inspiration to all of us!"

Fletcher first served as NASA administrator from April 1971 to May 1977. He was called back by President Reagan in May 1986 with a mandate to get the Space Shuttle flying again safely. By virtue of the two terms, Fletcher has served as NASA administrator longer than anyone. ■

## Major NASA Accomplishments During Dr. Fletcher's Current Term as Administrator

Following appointment by President Reagan, Dr. Fletcher was sworn in as NASA Administrator May 12, 1986, to guide NASA through the period of recovery from the Challenger accident which occurred Jan. 28, 1986. Under Dr. Fletcher's guidance, the agency achieved the following major accomplishments:

- Redesign of the solid rocket motor which was the direct cause of the Challenger accident.
- Reorganization of the Space Shuttle management structure to centralize control, clarify focal points of responsibility and provide for clear, uninhibited communication.
- Appointment of a number of high level managers, including several NASA center directors.
- Creation of a separate agency safety organization and a safety reporting system that guarantees anonymity.
- Reinstitution of a mixed fleet strategy that emphasizes use of expendable vehicles for missions that do not require human presence. One major goal of this strategy is to provide assured access to space by avoiding total reliance on a single launch system.
- Review and substantial redesign of the Space Shuttle system.
- Resumption of manned space flight with the STS-26 mission on September 29, 1988.
- Winning Presidential and Congressional approval to construct a replacement for Challenger.
- Reorganization of the agency's topmost management structure.
- Centralization of the management of Space Station development.
- Reaching final agreement with international partners for Space Station development.
- Creation of the NASA Office of Exploration to gather and analyze facts necessary for the President to make an informed decision about the nation's next major human activity in space. This was in response to the adoption, by President Reagan, of a new goal of national space policy - human exploration of the solar system.
- Completion of scientific investigation programs that established the presence of an ozone hole in the Antarctic, confirmed the threat to the ozone layer in the Arctic and considerably advanced knowledge about the greenhouse effect.
- Rapid mobilization of agency resources which provided science an unprecedented opportunity to study the development of a supernova and the process by which such an exploding star creates the material from which planets and even life forms are made.
- Placing the world's fastest supercomputer into operation at NASA's Ames aeronautics research facility in Mountain View, Calif.

NASA VISIONS

# Discovery's Return-to-Flight Photographs Record Many Firsts

Earth observation photographs taken by Discovery's crew during America's return to piloted space flight in 1988 were among the clearest in more than 20 years, and they captured a variety of environmental conditions.

Included in the astronauts' photography from the September 1988 mission is a photograph showing at least a one million square-mile smoke cloud over South America's Amazon River basin and, in Africa, evidence of flooding in areas that have experienced a lengthy drought.

Due to an unexpected improvement in atmospheric clarity over the Northern Hemisphere, the Discovery crew could distinguish ground details about 700 miles away from their spacecraft, much farther than has been normal for Space Shuttle flights. Visibility over the Northern Hemisphere during STS-26 was the best since the 1960s Gemini Program flights.

In total, the crew took 1,505 photographs of Earth during the 4-day mission. Discovery was launched into an orbit that kept it above only the tropical and subtropical regions of Earth. That orbit took the spacecraft over about half of Earth's surface, covering parts of 122 nations and regions that hold about 75 percent of the world's population.

Photographs show a dense, white smoke cloud, the result of tropical forest, pasture and croplands being cleared and burned, completely obscuring the ground over much of South America's Amazon River basin. If placed over the United States, the same cloud would cover an area of the country more than three times the size of Texas.

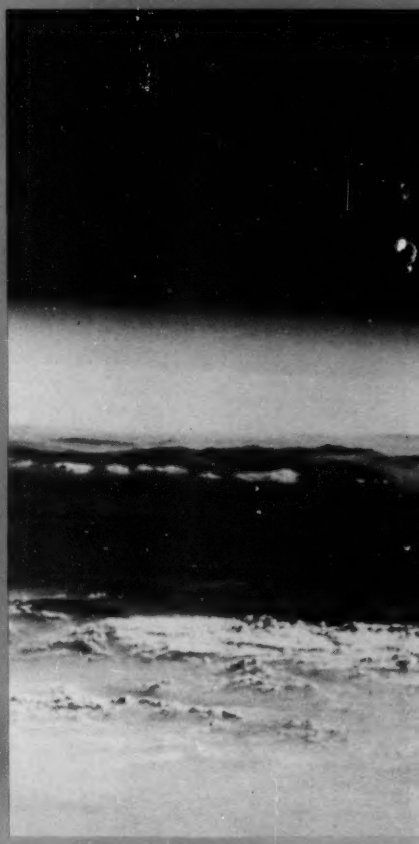
It is the largest and thickest accumulation of smoke ever photographed by astronauts, much larger than the previous largest smoke cloud photographed by astronauts over the same region in 1984.

STS-26 also photographed smoke clouds over Sumatra and Borneo, Indonesia, Madagascar, eastern Africa, northern Australia and Bolivia. Some photographs show apparent irrigation features in the tropics — in areas that normally receive 100 inches of annual rainfall.

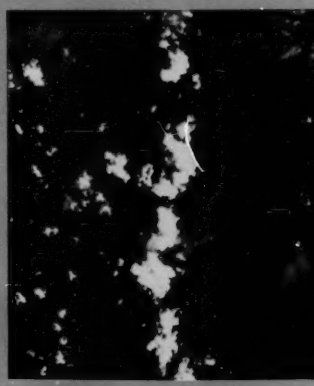
In Africa, the "green line" of vegetation that generally marks the southern boundary of the Sahara Desert had moved the farthest north it has been in astronaut photography since 1965. Also, standing water was photographed in the Sahara.

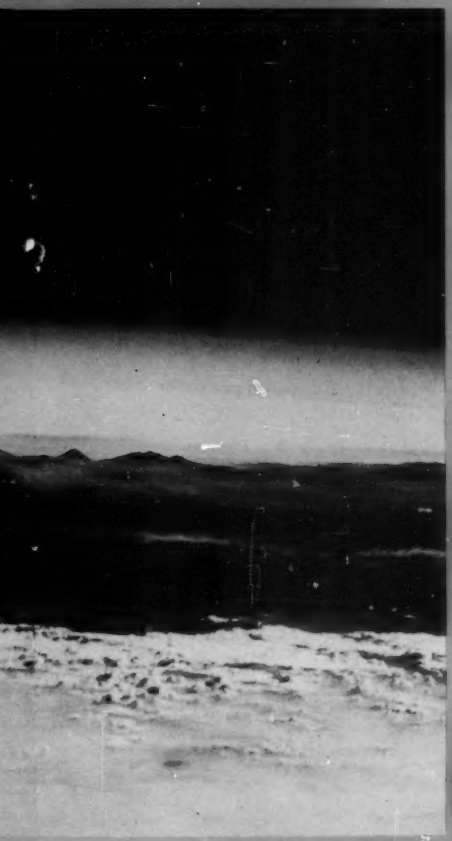
For the first time in Shuttle history, Africa's Niger river was photographed in full flood and out of its banks. Photographs of the Blue and White Nile rivers also showed evidence of recent flooding.

Throughout eastern Africa, the landscape was tinted with green, a condition never before seen in this region during the Shuttle program. Still, Africa's Lake Chad and Lake Nasser, two lakes that have long been studied by space photography, were at the lowest levels ever photographed by astronauts. Since 1960, Lake Chad's surface area is estimated to have declined by more than 90 percent. ■

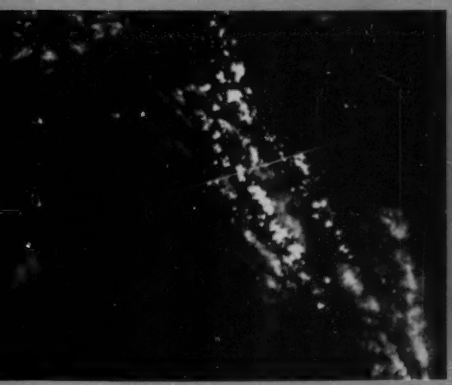


The western edge of a smoke cloud obscuring one-third of the Amazon basin meets the

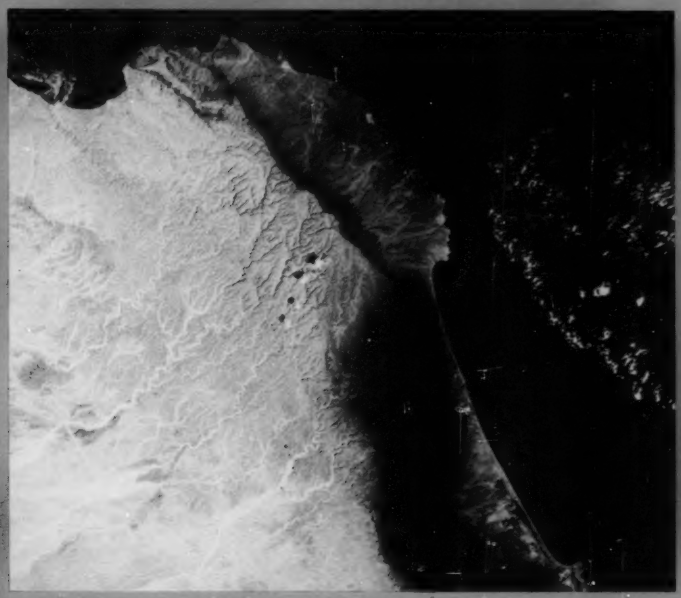




foothills of the Andes Mountains.



Jet aircraft leaves a contrail off the coast of Florida.



Vegetation near Oman's coast is the greenest seen in this area.(Top) South America's Amazon River basin shown on a cloudy day during the wet season of 1973. The photo was taken from Skylab 2.

## CENTER HIGHLIGHTS

### Gramm Visits Johnson Space Center, Predicts 'Make or Break' Year for Space

**By Kelly Humphries, JSC**

**JSC Director Aaron Cohen, left, responds to questions from Senator Phil Gramm, during a space station briefing recently. Clarke Covington, right, technical assistant to the director, also accompanied Gramm on the tour.**

This is a "make or break year" in Congress for America's space program, according to Sen. Phil Gramm, who toured the Space Station Freedom mockup at Johnson Space Center recently.

Gramm, R-Texas, met with JSC Director Aaron Cohen and other NASA officials March 23 in preparation for hearings of the Senate appropriations subcommittee that deals with NASA funding.

"If we are going to keep the Shuttle flying, we need to move ahead with full funding. If we're going to build a space station and build it on a timely and efficient basis, we need to begin this year with full funding," said Gramm.

"Our problem politically is a very simple one, and that is that investments in the next election are always popular in Congress; investments in the next generation are not always equally popular," he added.

Gramm, who noted that this will be the first time in 20 years that a Texan has sat on the Space Science and Technology subcommittee, said he will be involved in the space program budget debate three times this year, when it is considered by the subcommittee, the full committee and the full Senate. He said the space station decision now becomes political rather than technological.

"We have developed the technology needed to build the space station and we're now down to a decision as to whether we're going to go ahead and do it," he said. "I think we've come down to a moment of truth. Are we going to move ahead with the space station? Are we going to reassert our position of world leadership? Or, are we going to limp along with halfway measures?

"We have now had two presidents, in a very tight budget year, that have proposed full funding. It's now up to the Congress, it seems to me, to meet that challenge, and I'm hopeful that we can do it," he said, adding that the decision is important to JSC and Texas.

Cohen said that any congressional cuts in the "bare bones" NASA budget proposed by President Bush will result in fewer new jobs.

"I think if we do get a cut, it really is going to be a significant revamping of our total program, which will really stop the momentum," Cohen said. "The $300 million we are to spend on space station is about 3,300 jobs." "When you're talking about investing in the future of America, you're talking about making investments in Texas," Gramm said. "Certainly, that's true with the $2.1 billion proposed for the space station. It's true for the 22 percent increase in funding for NASA in general in the president's budget."

> "One of the problems with slowing things down and stretching things out is that costs go up and not down. Ultimately the taxpayer pays more."

"The budget we have set out is a budget that we need if we go at an efficient rate," Gramm added. "One of the problems with slowing things down and stretching things out is that costs go up and not down. Ultimately the taxpayer pays more." ■

## Advanced Wing Flight Program Completed, Symposium Held

**By Nancy D. Lovato, DFRF**

NASA's Ames-Dryden Flight Research Facility, Edwards, Calif., has successfully completed flight tests of the Mission Adaptive Wing, flown on the Advanced Fighter Technology Integration F-111 aircraft.

For the Mission Adaptive Wing program, the F-111's wing was modified so that the curvature of the leading and trailing edges could be varied in flight. The airplane then could fly with optimum wing curvature for subsonic, transonic and supersonic speeds, offering the potential for greater flight efficiency.

**Mission Adaptive Wing aircraft during initial flight.**

Reductions in air drag from eight to 20 percent were noted during the tests, as was a 20-percent reduction in wing bending during maneuvers. The airplane's handling qualities improved, with a significant delay in the onset of buffet around the wing.

During the final phase of the flight program, the wing system was evaluated in its automatic modes. Computer programs directed the system to adjust for optimum wing performance based on pilot inputs and other instrumentation information.

The Mission Adaptive Wing system performed reliably, with no in-flight failures during 144.9 flight hours. Four NASA and six Air Force test pilots flew the aircraft during the final phase for a total of 59 flights.

The prime objective of the program was to evaluate performance improvements created by the smooth, variable-camber Mission Adaptive Wing as compared to a fixed-camber wing.

"The performance of the wing showed improvements as predicted," says NASA Project Manager Louis L. Steers. "We'll be able to pass on our results to aircraft designers and the data should help with their future designs."

The program is a joint effort by NASA Ames-Dryden and the Air Force Wright Research and Development Center, Wright-Patterson Air Force Base, Ohio, with the Air Force Flight Test Center, Edwards Air Force Base, Calif., as a participating test organization. Boeing Advanced Systems, Seattle, Wash., built the Mission Adaptive Wing system.

NASA and the USAF Wright Research and Development Center hosted a symposium to present program results early this month at the Ames-Dryden Flight Research Facility.

## Search for Missing Planes: Sensors Quicker Than Eye?

NASA researchers and members of the New Mexico Wing Civil Air Patrol (CAP) participated in a NASA experiment recently to help determine the usefulness of airborne and spaceborne optical sensors as an aid in locating missing aircraft during search missions.

CAP members from Alamogordo and Roswell participated in the two-day effort along with the NASA rescue officials.

A NASA Lockheed C-130 aircraft and crew members from the Ames Research Center, Moffett Field, Calif., and researchers from the Goddard Space Flight Center, Greenbelt, Md., performed the experiment with the assistance of the CAP.

Goddard's Advanced Solidstate Array Spectroradiometer (ASAS) imaging instrument was mounted in the aircraft for the experiment. The ASAS camera takes x-ray and infrared pictures. The purpose of the experiment was to see if these images reveal downed aircraft that may be missed by the naked eye.

Members of the Alamorgordo CAP Unit provided NASA with the

*continued on page 14*

# Marshall Supports Technology Transfer

## Signs MOU with Alabama

**Marshall Space Flight Center Director James R. Thompson, Jr. (left) presents a 1988 copy of *NASA Spinoffs* to Alabama Governor Guy Hunt. Thompson and Hunt signed a memorandum of understanding in January which promotes the transfer of NASA-derived technology to that state's private sector.**

The Marshall Space Flight Center is stepping up its effort to transfer NASA technology to private industry.

As a result of the Center's initiative, Marshall signed a memorandum of understanding recently with the State of Alabama which promotes the transfer of NASA-derived technology to the state's private sector.

Following the signing of the agreement, the Center hosted on Feb. 9, more than 30 state leaders from Alabama and Tennessee at a day-long technology transfer orientation meeting to kick off the regional effort.

Leading the state delegations were Dr. D. Munsell McPhillips, chief of the Science, Technology and Energy Division of the Alabama Department of Economic Affairs, and Dr. John Crothers, State of Tennessee Department of Economic Community Development.

"The February meeting was a start. We intend to have more meetings and other activities with those agencies that are interested in making use of NASA's technology," said Ismail Akbay, director of Marshall's Technology Utilization Office.

The 30 representatives were from government agencies, the business sector and academia. They were welcomed by Center Director James R. Thompson, Jr., and received a NASA Headquarters' perspective on the technology transfer outreach program from Dr. Curtis Graves, deputy director of Civil Affairs at NASA Headquarters.

The group also received briefings on technical areas at Marshall, patent licensing, NASA computer programs, the Marshall Small Business Program and toured the Marshall Center. ■

## Sensors

**from page 13**

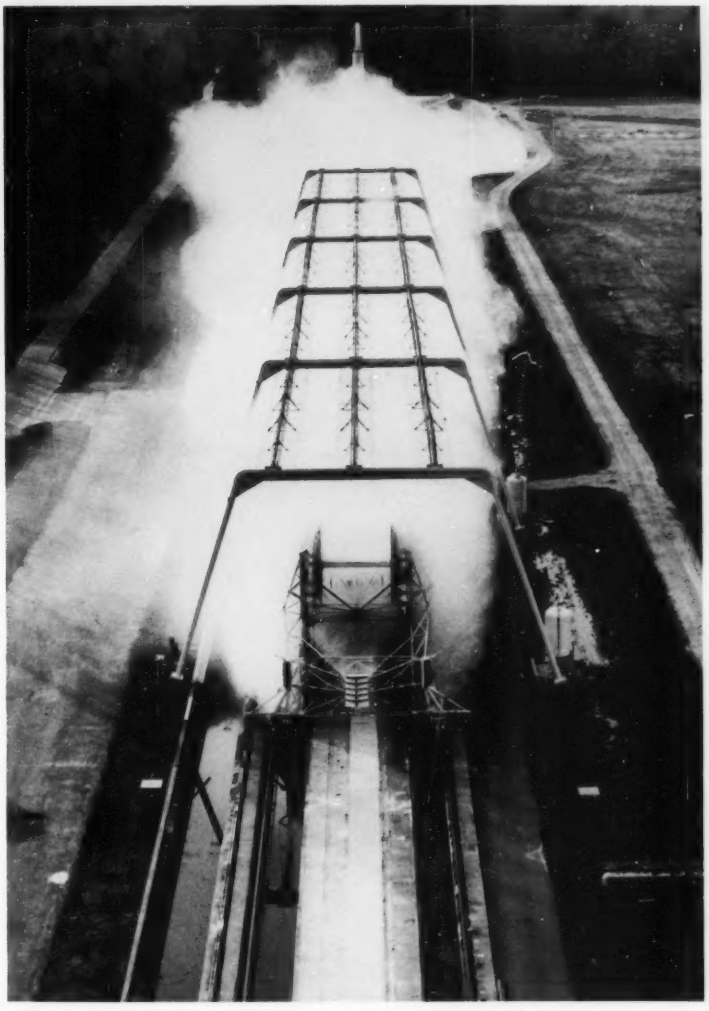
location coordinates of previously crashed aircraft near Alamorgordo which could be used as subjects for the airborne optical sensor.

Lt. Colonel Richard Himebrook, the Alamogordo Unit Commander, and Major Al Korzan coordinated the CAP activities. Major Carl Hendrickson and Lt. Bob Herr overflew the downed aircraft prior to the C-130 flight to find the best preserved wreckages, their status and locations. Korzan and Herr participated in a C-130 flight to point out the wreckages to the C-130 aircrew so they could execute the sensor overflights.

In another exercise, at Ranch airfield, located in Roswell, and an aircraft belonging to Lieutenants Tom and Linn Benedict, of the Pecos Valley Composite Squadron, were used to obtain baseline optical imagery data. The Benedict aircraft was placed at the far end of their airstrip, away from buildings, where the optical sensor could obtain data from an undamaged general aviation aircraft. This is usually the type of aircraft that the CAP attempts to locate.

The imagery collected from the Benedict aircraft will be used to create a standard signature. Variables such as the effect of Sun angle, and Sun glazing (the effect of the Sun when imaging the aircraft from different angles) will be built into the baseline. This information will be compared to the data collected at the actual crash sites to evaluate the effectiveness of the instrument in imaging crashed aircraft.

If this experiment and follow-on research proves successful, this technology may be used someday to assist the CAP in locating missing aircraft. The Goddard team is currently analyzing the test results. ■



**This giant, tinkertoy-like carriage is propelled to 155 mph in a preliminary NASA Langley test to measure the effects of "heavy rain" on aircraft wing performance. Mounted on top of the carriage is an aircraft wing section typical of a modern jetliner wing. The high-speed ground tests, conducted at Langley, simulate what an aircraft wing sees during heavy rain at landing or takeoff, generally considered the two most critical phases of flight.**
**Heavy rain is suspected of robbing aircraft of wing lift and creating a potential safety hazard at low altitudes. Wind tunnel tests suggest that heavy rain disrupts airflow and significantly reduces maximum wing lift. This loss of lift can be critical in some flight situations, such as in a windshear encounter. The high-speed carriage test will provide information needed to understand the potential influence of heavy rain on airplane performance and will result in the development of effective piloting procedures in critical flight conditions.**

## F-16XL Supersonic Airflow Flight Tests Planned

NASA's Ames-Dryden Flight Research Facility, Edwards, Calif., has taken delivery of the first of two U.S. Air Force-loaned F-16XL aircraft for a NASA flight research program.

The F-16XL aircraft is uniquely characterized by it's large cranked-arrow wing, especially well suited for efficient supersonic flight. The aircraft will be used by NASA as testbeds to evaluate aerodynamic concepts designed to improve wing air- flow during sustained supersonic flight.

Current aircraft designs, both subsonic and supersonic, result in turbulent airflow over the wing, air drag and reduced aircraft fuel efficiency. An aircraft's fuel consumption can be significantly improved if this airflow over the wing is maintained in a laminar (non-turbulent) condition. NASA has established the feasibility of laminar flow control technology by designing and flying several experiments demonstrating laminar flow over parts of a wing at subsonic speeds.

The initial experiments with the F-16XL aircraft will focus on concepts to achieve significant amounts of laminar air flow on the wing at supersonic speeds. This information is expected to aid in the design of future high speed aircraft.

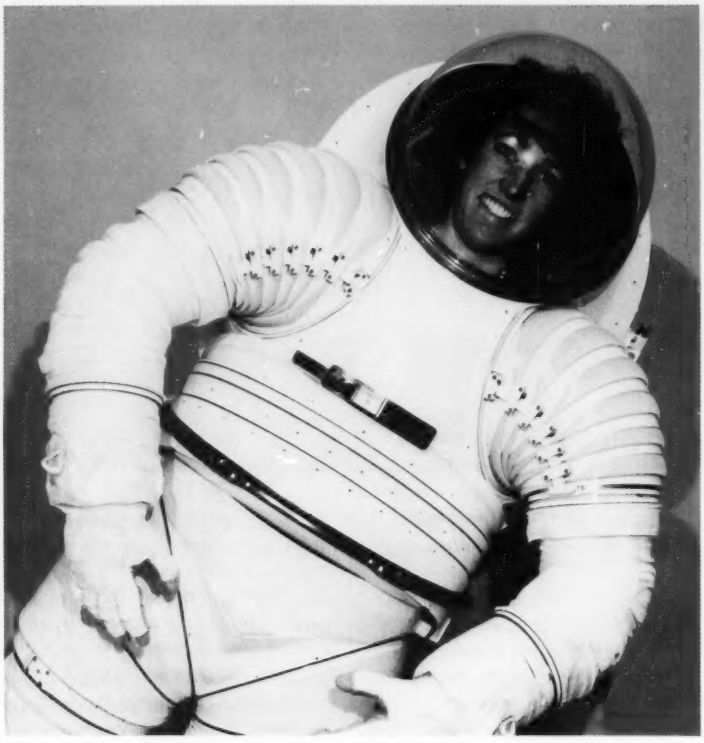
An experimental wing section will be installed which is perforated with thousands of tiny, laser-cut holes connected to an air pump mounted in the fuselage. The pump's suction will remove the turbulent layer of air next to the wing's surface, establishing laminar air flow. Instrumentation will acquire the flight data to validate the computer codes used to design the experiment and to quantify the experiment results. ■

Q&A

*The following questions and answers are excerpted from interviews conducted for NASA's radio program "The Space Story".*

## Space Suits for the Space Station

*Space suits for future missions are now being crafted which will be of much more convenience to astronauts. Space suits have come a long way from those custom-made during the Mercury, Gemini, and Apollo days. Joe Kosmo, manager of Space Suit Development at Johnson Space Center, is helping to develop a new extravehicular activity suit for the Space Station. Kosmo explains the elimination of the time-consuming preparation of pre-breathing for space walking astronauts.*



**Sue Schentrup trys out the zero-prebreathe Mark 3 spacesuit being studied at JSC.**

**Q What is pre-breathing and why is it a problem?**

A "The pre-breathing function is basically to eliminate nitrogen bubbles ("the bends") in the bloodstream that develop going from a higher cabin pressure of 14.7 pounds per square inch to a lower pressure before EVA. It's done by reducing the cabin pressure from six to twelve hours or by having the astronaut put on an oxygen mask and have him pre-breath three and a half to four hours. And that ties up his time.

**Q What problems do the higher pressure suits pose for the designer?**

A "Developing mobility joints for a suit that operates at higher pressure is somewhat of a challenge. I think the best way to visualize a joint for a spacesuit might be to think of a...long balloon and try to bend it. you'll find it's very difficult to bend. If you take that same balloon and take a series of rubber bands and put them on that balloon so that they actually form distinct break points, then you'll find that this will function much like a mobility joint system of a suit would function."

**Q The most technical part of the suit, surprisingly, is the glove. What makes the glove so difficult to design?**

A "The most difficult part of glove design, in my estimation, is achieving what I call the metacarpal joint, which is at the first large knuckle region of the hand at the start of the fingers and where the palm ends. If you'll look at your hand, you'll notice that all the grasping activity takes place basically in the metacarpal region... Up until the development of our higher operating pressure gloves, we didn't really have a metacarpal joint in our gloves. So the gloves got very fatiguing in operation." ■

# NASA NEWS CAPSULES

*News Capsules are NASA news releases edited by the Internal Communications Branch, Office of Communications.*

## Shuttle Orbiter-Naming Competition State-Level Winners Announced

NASA, in cooperation with the Council of Chief State School Officers (CCSSO), has announced the state-level winners in the national student competition to name NASA's replacement Space Shuttle orbiter.

Over 71,650 U.S. students, forming some 6,100 teams, each led by a school faculty member, in kindergarten through 12th grade, prepared and submitted educational research projects to support and justify the orbiter name submitted. The name proposed had to be that of a sea vessel used in research or exploration. The interdisciplinary classroom projects were completed during the 1988 fall semester and entries were submitted by Dec. 31, 1988.

The classroom projects were reviewed by panels selected by state education agencies in all 50 states, the District of Columbia, four U.S. territories, the Bureau of Indian Affairs, the Department of Defense and the Department of State schools. Winners were selected from two divisions, kindergarten through grade 6 and grades 7 through 12.

The state-level winning projects will be reviewed by a NASA panel. The final winner from each division and the name selected for the orbiter will be announced in early May. ■

## Space Shuttle Crew Members Named to DOD, Life Sciences Missions

NASA has named flight crew members to two Space Shuttle missions scheduled to fly in 1990. Navy Capt. John O. Creighton has been named to command shuttle mission STS-36, a Department of Defense-dedicated flight aboard Atlantis set for February 1990. USAF Col. John H. Casper will serve as pilot. Mission specialists are USMC Lt. Col. David C. Hilmers, USAF Col. Richard M. Mullane and USN Lt. Cmdr. Pierre J. Thuot.

Creighton has flown as pilot on mission STS-51G. Casper will be making his first space flight. Hilmers has flown as a mission specialist on STS-51J and STS-26. Mullane has flown as a mission specialist on two flights, STS-41D and STS-27. Thuot is making his first flight in space.

Two NASA astronauts also have been named as mission specialists aboard the Space Shuttle Columbia on mission STS-40. M. Rhea Seddon, M.D., and James P. Bagian, M.D., have been assigned to the space life sciences-dedicated mission, SLS-1, scheduled for launch in June 1990.

Seddon has flown on mission STS-51D as a mission specialist. Bagian flew his first space flight aboard Discovery on mission STS-29 as a mission specialist.

Additional SLS-1 crew members were named in April 1985. They are payload specialists F. Drew Gaffney, M.D., University of Texas Health Science Center; and Robert W. Phillips, M.D., Colorado State University.

The SLS-1 partial crew assignment will provide for long-range crew participation in payload training and integration. The remainder of the flight crew will be assigned later. ■

## New Earthquake Faults Discovered with Landsat Images

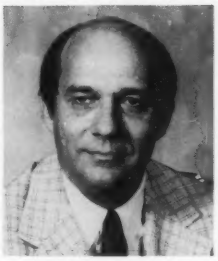
Several previously unknown geological faults, some of which may be active, have been discovered in the central and eastern Mojave Desert in California by geologists at NASA's Jet Propulsion Laboratory (JPL), and Louisiana State University analyzing images from an Earth orbiting Landsat satellite.

The strike slip faults were identified by images taken by the Thematic Mapper (TM) instrument on Landsat 5, which obtains images simultaneously in seven bands at optical and infrared wavelengths. Scientists used the TM images as a "map" which pointed them in the right direction to locate and confirm the faults in the field.

The newly observed faults are located in and near the unpopulated Bristol Mountains and Cady Mountains. Scientists have determined that the faults in the Bristol Mountains are overlain by unconsolidated alluvial fan debris (gravel) and are probably inactive. In contrast, faults lying to the west (Cady Mountains) cut all deposits and are seismically active. The faults all form part of a complex regional network of right-slip faults that run between the Death Valley region and the San Andreas Fault System.

The newly observed faults are much smaller and less active than the San Andreas Fault but they all show evidence of a strike slip. During an earthquake, movement on a strike-slip fault is dominantly horizontal and parallel to the trend of the fault. Scientists are now trying to determine how the newly observed faults fit into the regional structure in this part of the Earth's crust. ■

## Thompson Named Deputy Administrator, Myers Departs



J.R. Thompson

The former director of NASA's Marshall Space Flight Center has been named as NASA's deputy administrator by President Bush. James R. (J.R.) Thompson was nominated to the post April 12.

As Deputy to the Administrator, Thompson will assist the administrator in expediting the programs and goals of the nation's civil space program.

Thompson became Marshall director in September of 1986, after serving three years as deputy director for technical operations Princeton University's Plasma Physics Laboratory in Princeton, N.J.

Thompson served as vice-chairman of the NASA task force inquiring into the cause of the Space Shuttle Challenger accident. In that capacity, he headed the day-to-day operations of the 51-L Data and Design Analysis Task Force, which collected and analyzed accident-related information in support of the Presidential Commission on the Space Shuttle Challenger Accident.

Prior to assuming his position at Princeton University, Thompson spent 20 years with NASA at the Marshall Space Flight Center in various positions, including associate director for engineering in th Science and Engineering Directorate and as manager of the Space Shuttle Main Engine Project in the Shuttle Projects Office.

Thompson began his professional career in 1960 as a development engineer with Pratt and Whitney Aircraft in West Palm Beach, Fla.

He joined NASA Marshall in 1963 as a liquid propulsion system engineer working with the Saturn launch vehicle J-2 engine system. In 1966 he joined the Space Engine Section in the former Propulsion and Vehicle Engineering Laboratory and became chief of the section in 1968.

From 1969 to 1974 he served as chief of the Man/Systems Integration Branch and in September 1964 he was named manager of the Main Engine Projects office. In that position he was responsible for the development and operation of the most advanced liquid propulsion rocket engine ever developed: from the beginning of early development testing on the Shuttle main engine through the initial Shuttle flights.

In February 1982, Thompson was named associate director for engineering in the Science and Engineering Directorate. ■

Dale D. Myers

Dale D. Myers, NASA's acting administrator and its deputy administrator since October 1986, has departed the agency after a total of over six years service.

From 1984 to 1986, Myers was a private consultant in the aerospace and energy fields. He also served as an at-large member to the NASA Advisory Council, the organization created to provide advice and counsel to top management on aeronautics and space programs.

Myers served as President and Chief Operating Officer of Jacobs Engineering Group, Inc., Pasadena, Calif., from 1979 to 1984.

From 1977 to 1979 Myers was Under Secretary of the U.S. Department of Energy following his vice-presidency at Rockwell International and his Presidency of North American Aircraft, El Segundo, Calif.

Myers joined North American-Rockwell in 1964 and served as the company's Apollo Command/Service Module Program Vice-president and Program Manager until 1969 when he became Vice-President/Program Manager of the Space Shuttle Program, Rockwell International.

He was named NASA's associate administrator for Manned Space Flight in 1970 and served in that capacity until 1974 when he returned to North American-Rockwell.

Commenting on the President's nomination of Truly and Thompson to NASA's top two posts, he said, "I am delighted by President Bush's nomination of Dick Truly to be the next Administrator of NASA. During the past three years I have come to know Admiral Truly and his capabilities well. His experience and accomplishments demonstrate that he is well qualified to lead America's civil space program into a period of significant expansion of scientific, commercial and exploratory activities.

"In nominating J.R. Thompson...the President has created a superb team to guide NASA into the future.

"All of my colleagues at NASA are delighted with these nominations." ■

# HUMAN FACTORS

## Rosen Named OAST Acting Associate Administrator

Dr. Robert Rosen has been named acting associate administrator for aeronautics and space technology (OAST). Rosen has served as deputy associate administrator OAST since March 1986.

Rosen replaces acting associate administrator Dr. William F. Ballhaus, Jr. who returned to his permanent position as director of NASA's Ames Research Center, Mountain View, Calif.

In his new position, Rosen will be responsible for the direction of NASA's aeronautics and space technology programs, as well as for the institutional management of NASA's Ames Research Center, Langley Research Center and Lewis Research Center.

Rosen joined NASA Headquarters in April 1985 as the director, propulsion, power and energy division, OAST. Prior to coming to NASA, Rosen held key positions in private industry, including Rocketdyne, Canoga Park, Calif., 1979-1985, and McDonnell Douglas Astronautics Company, Huntington Beach, Calif., 1968-1979.

Rosen received a bachelor of science degree in 1960 from the University of Miami, Coral Gables, Fla; a master of science degree in 1962 from Northwestern University, Evanston, Ill.; a mechanical engineering degree in 1966 from the California Institute of Technology, Pasadena; and a Ph.D. in 1968 from the University of Southern California, Los Angeles. ■

## Lamar Awarded Dryden Fellowship

Dr. John E. Lamar, Langley Research Center, has been awarded the National Space Club's Dryden Memorial Fellowship.

Lamar was recognized at the Space Club's thirty-second annual Goddard Memorial Dinner, held in Washington.

The Dryden Fellowship was established in 1966 to provide for the further education of deserving individuals in diciplines applicable to science, astronautics and space administration.

Lamar will spend an academic year at the Naval Postgraduate School, Monterey, Calif., where he will study with Turgot Sarpkaya, an authority on vortex dynamics. Lamar's study will focus on current solution techniques applied to a variety of vortical flow problems, including those in disciplines other than aeronautics, such as meteorology.

Lamar views vortices as the fundamental building blocks of fluid mechanics and has been extensively involved in Langley-led vortex flap research.

He is currently on temporary assignment to the Conceptual Studies Office, National Aero-Space Plane program.

The scholarship is awarded in memory of Hugh L. Dryden, former NASA deputy administrator and NACA director, who played a uniquely important role in the development of science-based technology. ■

## Senior Executive Association Honors Ballhaus

**Dr. William F. Ballhaus, Jr., (2nd right) receives Distinguished Executive Service Award from Senior Executive Association chairman Stephen J. Flaherty, Sr. (right). Accompanying (from left) Dr. Noel Hinners, NASA associate deputy administrator and Mrs. Jane Ballhaus.**

The Senior Executive Association/Professional Development League has bestowed its Distinguished Executive Service Award on Ames Research Center Director Dr. William F. Ballhaus, Jr., during recent ceremonies in Washington.

The award recognizes "his career-long commitment to excellence and the ...development of computer codes for transonic flow simulation which revolutionized traditional engineering methods of aerodynamic design. His vision for widespread application of computational fluid dynamics led him to successfully advocate a numerical aerodynamic simulation project, the world's most powerful supercomputer complex."

Ballhaus was one of six government senior executives honored for 1988. ■

# ANOTHER DIVIDEND FROM AIR & SPACE

## Automatic Glucose Monitor for Diabetics

An implantable device that would mark a major advance for insulin-dependent diabetics is now being developed in a collaborative effort among the Johns Hopkins University Applied Physics Laboratory (APL), Laurel, Md.; the University of New Mexico (UNM), Albuquerque, N.M.; and NASA's Goddard Space Flight Center, Greenbelt, Md.

Currently known as rechargeable physiologic sensor (RePS), the device would eliminate the numerous daily finger pricks, required of the estimated 1 million Type 1, insulin-dependent patients in the U.S., for proper monitoring of glucose level. The device also would provide a more accurate analysis of glucose level than is possible with finger-prick techniques.

APL's Program Manager for RePS, Wade Radford, said the proposed unit will determine the glucose level using a sensor designed by Dr. Ebtisam Wilkins at UNM. Electronics, designed by engineers at APL, will amplify the electronic signal identified by the sensor and send the signal to a receiving unit outside the body, using technology similar to that used by orbiting satellites to telemeter data back to Earth, according to Donald S. Friedman, chief, office of commercial programs at Goddard.

> ...a prototype could be completed by the end of 1989 and a unit could be on the market in about four years.

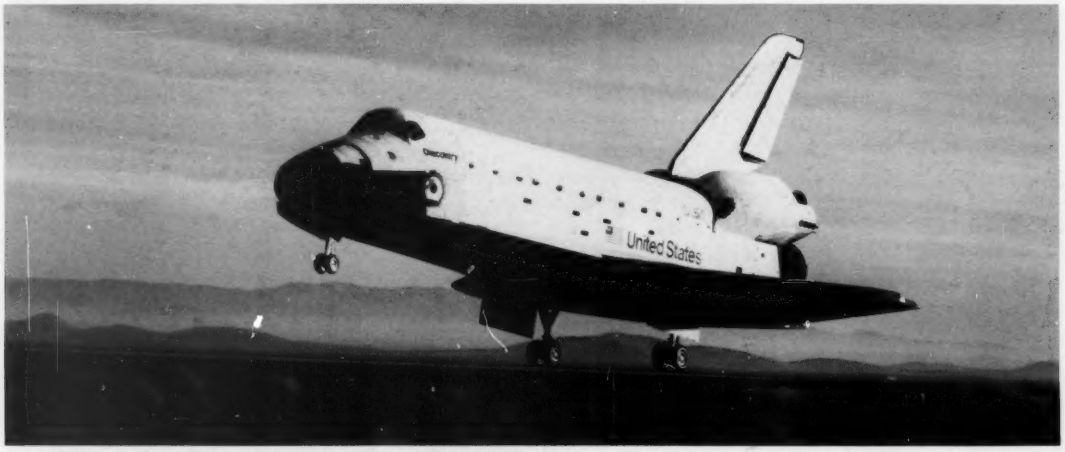
The external, hand-held unit then would display the numerical glucose reading necessary for accurate insulin dosage, said Friedman, who also is Goddard program manager for the RePS.

The telemetry system operates on a lithium battery similar in power and size to those used in hearing aids. Because the unit does not need to contact the blood directly, but instead monitors the electrical charge produced when glucose in the body tissue is in proximity to a metallic glucose salt compound present in the device, it can be placed just under the skin in the abdominal area.

RePS brings to the field of glucose sensor development a quicker, more accurate way to monitor glucose level while eliminating the discomfort of repeated finger pricking. Such accurate monitoring and subsequent control of blood glucose should greatly decrease the severity of diabetic complications according to the developers. RePS also is designed to be rechargeable in one step, unlike most other glucose sensors currently being designed.

RePS is being developed as part of a Goddard/APL collaborative program for the development of biomedical implantable devices.

Researchers expect that a prototype RePs will be completed by the end of 1989 and that a unit could be on the market in about four years. ■




**Its TDRS deployment mission complete, STS-29 Discovery returns from space to a landing at Ames-Dryden Flight Research Facility, Edwards AFB, California.**